WHAT IS CLAIMED IS:

1. In a multicarrier communication system that transmits through a band-limited wireline communication channel a sequence of N-element time domain signal vectors, a method of transmission, comprising;

estimating an impulse response convolutional model for the band limited wireline communication channel to define an L-element channel vector, whereby the channel output to a given one of the time domain signal vectors is modeled as being substantially equal to a linear convolution of the channel vector with the respective N-element time domain signal vector, plus a noise vector;

precoding each of a set of frequency-domain encoded data blocks using a precoder to derive a set of precoded data vectors;

transforming each of the precoded data vectors to a respective one of the time domain signal vectors; and

transmitting the time domain signal vectors onto the band-limited wireline communication channel to be received by a far-end receiver;

wherein the precoder comprises:

a set of precoder parameters which are each at least partially derived from the L-element channel vector, the precoder parameters comprising a precoder feed forward parameter vector, and a precoder feed feedback parameter vector,

a point-wise feed forward multiplier that multiplies each element of an internal precoder feed-forward vector with a corresponding element of the precoder feed forward parameter vector, and

a point-wise feed back multiplier that multiplies each element of a precoder feed-back vector with a corresponding element of the precoder feed feedback parameter vector;

whereby the precoder performs a vector precoding operation and avoids the need to compute one or more $O(N^2)$ matrix multiplication operations.

2. The method of claim 1, wherein the precoder further comprises a vector modulo reduction unit which computes a pair of integer residues for the real and imaginary components of each element of a vector applied to the input of the modulo reduction unit.

3. The method of claim 1, wherein the precoder is embodied as a set of software functions.

4. The method of claim 1, wherein the L-element channel vector is calculated during an initial training sequence carried out with the far end receiver across the wireline communication channel by sending one or more training signals through the wireline communication channel and estimating the impulse response of the channel.

5. For use in a multicarrier communication system that transmits through a band-limited wireline communication channel a sequence of N-element time domain signal vectors, a transmission apparatus comprising:

a processor;

a computer readable storage medium;

a software instantiated in the computer readable storage medium, the software comprising:

a first function that causes one or more training signals to be sent through the wireline communication channel to a far-end receiver to cooperatively estimate a set of channel parameters for a parametric model, wherein the parametric model models how signals are modified by the band-limited wireline communication channel as the signals pass through the band-limited wireline communication channel to the far-end receiver;

a second function that causes a set of precoder parameters to be computed at least partially based upon the channel parameters, the precoder parameters comprising a precoder feed forward parameter vector and a precoder feedback parameter vector,

a third function that causes each of a set of frequency-domain encoded data blocks to be transformed to a set of precoded data vectors, wherein the third function comprises:

a point-wise modulo reduction function that causes a set of integer modulo reduction operations to be applied to each of the real and imaginary components of a plurality of elements of a frequency domain vector;

a point-wise feed forward multiplier function that causes each element of an internal precoder feed-forward vector to be point-wise multiplied with a corresponding element of the precoder feed forward parameter vector, and

a point-wise feed back multiplier function that causes each element of a precoder feed-back vector to be point-wise multiplied with a corresponding element of the precoder feed feedback parameter vector;

a fourth function that causes the precoded data vectors to be transformed to a respective one of the time domain signal vectors; and

a fifth function that causes the time domain signal vectors to be transmitted onto the band-limited wireline communication channel to be received by a far-end receiver.

6. The apparatus of claim 5, wherein the second function also computes a vector of complex integer moduli to be used by the point-wise modulo reduction function.

7. The apparatus of claim 5, wherein the third function further comprises a frequency domain up-sampling function to transform an N-element frequency domain vector to a 2N-element frequency domain vector.

8. The apparatus of claim 5, wherein at least one of the feed-forward and feedback point-wise multiply functions operate on length 2N element vectors.

9. The apparatus of claim 5, wherein at least one of the precoder feed-forward parameter vector and the precoder feedback parameter vector have 2N elements.

10. In a multicarrier communication system that transmits through a band-limited wireline communication channel a sequence of N-element time domain signal vectors, a method of transmission, comprising;

estimating an impulse response convolutional model for the band limited wireline communication channel to define an L-element channel vector, whereby the channel output to a given one of the time domain signal vectors is modeled as being substantially equal to a linear convolution of the channel vector with the respective N-element time domain signal vector, plus a noise vector;

precoding each of a set of frequency-domain encoded data blocks using a precoder to derive a set of precoded data vectors, the precoder comprising a set of precoder parameters which are each at least partially derived from the L-element channel vector;

transforming each of the precoded data vectors to a respective one of the time domain signal vectors; and

transmitting, back to back without a time domain guard interval, the time domain signal vectors onto the band-limited wireline communication channel to be received by a far-end receiver;

wherein the precoder parameters are selected and the precoding is performed to compensate for time-domain inter-vector interference that would otherwise be introduced by transmitting the time domain signal vectors through the band limited wireline communication channel; and

whereby the precoder alleviates the need to insert the guard interval between adjacent N-element time domain signal vectors and alleviates the need for a time domain equalizer to compensate inter-vector interference between signal vectors received at a receiver located at the output of the communication channel.

11. The method of claim 10, wherein the precoder is further selected to compensate for time-domain intra-vector interference that would otherwise be introduced by transmitting the time domain signal vectors through the band limited wireline communication channel.

12. The method of claim 10, wherein the precoder is further selected to modify the frequency domain power spectrum to the transmitted set of time-domain signal vectors in order to meet a power constraint imposed by the wireline communication system, and whereby a frequency domain equalizer located within the far-end receiver can restore the original spectral properties of the encoded data using a point-wise multiplication operation in the frequency domain.

13. The method of claim 10, wherein the L-element channel vector is calculated during an initial training sequence carried out with the far end receiver across the wireline communication channel by sending training signals through the wireline communication channel and estimating the impulse response of the channel.

14. The method of claim 10, wherein the precoding involves applying a nonlinear operation to each element of an intermediate frequency domain vector calculated by said precoder.

15. The method of claim 14, wherein the nonlinear operation comprises an integer arithmetic operation.

16. The method of claim 15, wherein the integer arithmetic operation comprises a modulo reduction operation which is applied to a each of a set of frequency domain vector elements and is performed according to a pair of integer moduli individually selected for the real and imaginary components of each said element.

17. The method of claim 10, wherein the precoding involves a point-wise modulo reduction operation, a feed-forward point-wise multiplication operation, and a feedback point-wise multiplication operation.

18. The method of claim 17, wherein at least one of the feed-forward and feedback point-wise multiply operations operate on length 2N element vectors.

19. In a multicarrier communication system that transmits through a band-limited wireline communication channel a sequence of N-element time domain signal vectors, a method of transmission, comprising;

sending training signals through the wireline communication channel to a far-end receiver to cooperatively estimate a set of channel parameters for a parametric model, wherein the parametric model models how signals are modified by the band-limited wireline communication channel as the signals pass through the band-limited wireline communication channel to the far-end receiver;

precoding each of a set of frequency-domain encoded data blocks using a precoder to derive a set of precoded data vectors, the precoder comprising a set of precoder parameters which are each at least partially derived from the channel parameters, the precoder further comprising a point-wise modulo reduction unit that applies a set of integer modulo reductions to an intermediate precoder vector in a transform domain different from the time domain of the signal vectors;

transforming each of the precoded data vectors to a respective one of the time domain signal vectors; and

transmitting, back to back without a time domain guard interval, the time domain signal vectors onto the band-limited wireline communication channel to be received by a far-end receiver;

wherein the precoder parameters are selected and the precoding is performed to compensate for time-domain inter-vector interference that would otherwise be introduced by transmitting the time domain signal vectors through the band limited wireline communication channel; and

whereby the precoder alleviates the need to insert the guard interval between adjacent N-element time domain signal vectors and alleviates the need for a time domain equalizer to compensate inter-vector interference between signal vectors received at a receiver located at the output of the communication channel.

20. The method of claim 19, wherein the precoding involves a feed-forward point-wise multiplication operation, and a feedback point-wise multiplication operation. .

21. The method of claim 20, wherein at least one of the feed-forward and feedback point-wise multiply operations operate on length 2N element vectors.